CLAIMS

What is claimed is:

1. A method of substantially continuously optimizing a stochastic parameter ϑ that characterizes the instantaneously prevailing readiness with which crop is processed in a harvesting machine, including the step of recursively calculating the optimized parameter value in accordance with the following algorithm:

$$\hat{\vartheta}(t) = f(\hat{\vartheta}(t-1), \varepsilon(t, \hat{\vartheta}(t-1))) \qquad \text{- (A)}$$

wherein:

$\hat{\vartheta}(t)$ is the optimized stochastic parameter value at time t; and

$\varepsilon(t, \hat{\vartheta}(t))$ is an error prediction function.

2. A method according to claim 1, wherein the algorithm (A) has the form:

$$\hat{\vartheta}(t) = f\left(\hat{\vartheta}(t-1),..., \hat{\vartheta}(t-n_{\vartheta}), \varepsilon(t),..., \varepsilon(t-n_{\varepsilon}), t\right).$$

3. A method according to Claim 1, wherein the algorithm (A) has the form:

$$\hat{\vartheta}(t) = \hat{\vartheta}(t-1) + \gamma(t) r^{-1}(t) \psi\left(t, \hat{\vartheta}(t-1)\right) \varepsilon\left(t, \hat{\vartheta}(t-1)\right)$$

wherein:

$\gamma(t)$ is a gain term;

$r(t)$ is a scalar approximation of a Hessian $V''(\vartheta)$ in which V is a quadratic error criterion;

$\psi(t, \vartheta) = \dfrac{d\hat{y}(t, \vartheta)}{d\vartheta}$, in which $\hat{y}(t, \vartheta)$ is an estimation of a value indicative of the effectiveness of crop processing in said harvesting machine, said estimation being based on stochastic parameter ϑ; and

$\varepsilon(t, \hat{\vartheta}(t-1))$ is the difference between the actual effectiveness value $y(t)$ and the estimated value $\hat{y}(t, \vartheta)$ based on the previously optimized parameter $\hat{\vartheta}(t-1)$.

4. A method according to Claim 3, wherein the algorithm (A) includes an estimation of $r(t)$ that is weighted to reduce the influence, on the optimized parameter values $\hat{\vartheta}$, of past measurements.

5. A method according to Claim 3, wherein:

said stochastic parameter ϑ is usable in a model for the relation between a value *u(t)* indicative of the feedrate of crop into the harvesting machine and a value *y(t)* indicative of the effectiveness of an operation processing said crop in said harvesting machine; and

said value $\hat{y}(t,\vartheta)$ is an estimation value of the effectiveness obtained by the application of said model to the feedrate values *u(t)*.

6. A method according to Claim 5, wherein said model comprises an exponential function.

7. A method according to Claim 6, wherein said model has the form:

$$\hat{y}(t,\vartheta) = \exp(\vartheta u(t)) - 1. \qquad \text{- (B)}$$

8. A method according to Claim 5, wherein:

said crop processing comprises separating useable crop parts from other plant matter; and

said value *y(t)* is indicative of a flow of useable crop losses in a selected part of the harvesting machine.

9. A method according to Claim 5, wherein:

said crop processing operation comprises separating useable crop parts from other plant matter; and

said value *y(t)* is indicative of a flow of return crop in a selected part of the harvesting machine.

10. A method of operating a harvesting machine comprising the steps of:

substantially continuously optimizing a stochastic parameter ϑ that characterizes the instantaneously prevailing readiness with which the harvesting machine processes crop; and

substantially continuously adjusting a performance variable of the

harvesting machine in dependence on the instantaneous, optimized value $\hat{\vartheta}$ of said parameter in order to optimize the load of the harvesting machine so as to keep a value *y(t)* indicative of the effectiveness of said harvesting machine below a predetermined value.

11. A method according to Claim 10, wherein:

processing the crop comprises separating useable crop parts from other plant matter;

optimizing the load of the harvesting machine comprises optimizing the feedrate *u(t)* of crop into the harvesting machine; and

the effectiveness value comprises losses *y(t)* of useable crop parts.

12. A method according to Claim 10, wherein the step of continuously optimizing a stochastic parameter ϑ includes carrying out the method steps of Claim 1.

13. A method according to Claim 10, wherein the step of adjusting a performance variable of the harvesting machine occurs in dependence on the output of an inverted form of a yield loss estimation function:

$$\hat{y}(t,\vartheta) = \exp(\vartheta u(t)) - 1. \qquad \text{- (B)}$$

14. A method according to Claim 10, wherein adjusting a performance variable comprises adjusting the travel speed of said harvesting machine or the actual cutting width of a header of said harvesting machine.

15. A method of mapping one or more field lots for variations in a stochastic parameter ϑ that characterizes the instantaneously prevailing readiness with which crop is processed in a harvesting machine, the method comprising the steps of:

operating a harvesting machine to harvest crop in a field lot;

simultaneously measuring the machine load and the machine effectiveness and determining the position of the machine in the field lot;

storing data indicative of the position of the harvesting machine at time *t*;

using the measured machine load data *u(t)*, and machine effectiveness data *y(t)* in an optimization of said parameter ϑ; and

mapping the optimized parameter values $\hat{\vartheta}$ obtained from the step of using the measured machine load data *u(t)* and machine effectiveness data *y(t)* in an optimization of said parameter ϑ; so as to produce a parameter map of the field lot.

16. A method according to Claim 15, wherein the step of using the measured machine load data *u(t),* and machine effectiveness data *y(t)* in an optimization of said parameter ϑ includes carrying out an optimization according to Claim 1.

17. A method of operating a harvesting machine comprising the steps of:

substantially continuously optimizing a stochastic parameter ϑ that characterizes the instantaneously prevailing readiness with which the harvesting machine separates useable crop parts from other plant matter; and

sending a display signal, that is indicative of the instantaneous parameter value $\hat{\vartheta}$, to a display device.

18. A method according to Claim 17, wherein the step of optimizing a stochastic parameter ϑ includes carrying out the method of Claim 1.

19. A method according to Claim 17, wherein the display signal indicates an abnormal parameter value $\hat{\vartheta}$.

20. A methods according to Claim 1, wherein said harvesting machine is a combine harvester and the crop is a grain-bearing plant.

21. A method according to Claim 8, wherein said selected part of the harvesting machine is:

the straw walkers;

the rotary separator;

the sieves;

the grain elevator;

the return flow system;

the cleaning section; or

the axial threshing and separating rotor;

of a combine harvester.